Engineering Study

For Submittal To:
Pennsylvania Department of Environmental Protection

In Response To:
Order Dated September 24, 2009

Prepared for:

Prepared by:
URS Corporation

October 9, 2009

October 9, 2009

DIM0198291

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Statement of Limitations: *This study is intended for the sole use of Cabot Oil and Gas Corporation. The scope of services performed may not be appropriate to satisfy the need of other users, and any use or re-use of this document or of the findings, conclusions, or recommendations presented herein is at the sole risk of said user. Background information, design bases, and other data have been furnished to URS by Cabot Oil and Gas Corporation and/or third parties, which URS has used in preparing this study. URS has relied on this information as furnished, and is neither responsible for, nor has confirmed the accuracy of this information.*

1.0 Introduction

On September 24, 2009, the Pennsylvania Department of Environmental Protection (PADEP) issued an Order to Cabot Oil &Gas Corporation (Cabot) relating to its hydraulic fracturing (frac) operations in Susquehanna County, PA. The Order sets forth a summary of releases associated with fracing at the Heitsman 4H well pad site and alleges several regulatory violations. The Order requires the cessation of hydraulic fracturing activities, the submittal of an engineering study, and the submittal of an updated Preparedness, Prevention, and Contingency Plan (PPC Plan), including an updated Control & Disposal Plan (C&D Plan).

This engineering study addresses Section 4 of the Order and provides an evaluation of the releases, an equipment and work practices integrity analysis, and corrective measures that Cabot will employ at the Heitsman 4H and other hydraulic fracturing well pads. This study also includes site photos (Attachment 1) and figures demonstrating site features.

The study was prepared by URS Corporation. URS is one of the largest, global, fully integrated engineering, construction and technical services firms in the United States. URS offers professional planning, design, environmental, construction, program and construction management, operations and maintenance, management and a wide range of specialized technical services for the oil and gas, chemical and pharmaceutical, manufacturing, mining, and pulp and paper industries. URS also provides engineering and planning services to the transportation, power, industrial infrastructure and process, environmental and nuclear management, water/wastewater, and mining industries. URS offers extensive experience in due diligence and compliance audits, permitting, environmental management and pollution control, waste management and remediation engineering, and process engineering and design. URS leads the industry in evaluating and implementing pollution control systems and waste remediation programs. Brief biographies of the individuals involved in the preparation of this study are contained in Attachment 2.

2.0 Evaluation of Releases

This section provides a detailed explanation of the causes of the releases that occurred during frac activities at the Heitsman 4H site on September 16 and 22, 2009. The fracing operation on Heitsman 4H was being performed by multiple contractors, with oversight by a Cabot completion foreman.

There were three (3) distinct releases of "frac fluid" from the Heitsman 4H well pad during this period, which were all reported to the PADEP. Frac fluid is a mixture consisting of fresh water and a liquid gel concentrate called LGC-35 CBM, or "frac gel" (MSDS are included in Attachment 3). Frac fluid is mixed at a ratio of 5 gallons of frac gel to 1,000 gallons of fresh water, resulting in a mixture that is 99.5 percent water and 0.5 percent frac gel.

The frac fluid releases at the Heitsman 4H location were caused by equipment failures resulting from pressure surges in the water transfer system. A factor contributing to the pressure surges is the elevation difference of approximately 240 feet between the frac tank farm where the water source was stored and the well pad (**Figure 1**). The hydrostatic pressure resulting from this elevation difference combined with pressure fluctuations associated with fracing resulted in the pressure rating of some piping components being exceeded. Similar topographic conditions have not been encountered at other Cabot fracing locations.

2.1 September 16, 2009 2:00 PM Release

According to the Cabot incident report, the initial release occurred shortly after contract personnel opened a lever-type valve on the discharge from a 21,000-gallon feed tank located on the Heitsman 4H well pad (**Figure 2**). The mechanical coupling on a suction hose at the valve on an adjacent tank became uncoupled and approximately 1,050-2,100 gallons of frac fluid (fresh water and gel mixed at the prescribed 1,000:5 ratio) was released to the well pad surface before the coupling could be reattached (**Figure 3**)[1]. The coupling did not appear damaged. It has not been definitely determined, but the fast-acting lever valves may have contributed to a pressure surge that may have been related to this coupling failure. A portion of the release drained from the well pad to a forested wetland adjacent to the pad, and eventually reached Stevens Creek. As summarized below, due to the immediate response measures taken by on-site contractor personnel, a significant volume (approximately 800 gallons) of the release was isolated from reaching the adjacent wetland and creek.

According to the Cabot incident report, the Cabot completion foreman on site immediately called for contractor cleanup response crews, who arrived to remediate the spill. A contractor crew that was already on site worked to contain the spill while the cleanup crews were en route. PADEP was notified of the spill by the Cabot drilling foreman at approximately 2:30 PM.

Contractor cleanup crews constructed a hay bale and earth dam containment basin off the southeastern corner of the well pad (**Figure 2**). A second temporary hay bale and earth dam was placed within Stevens Creek to prevent downstream migration. Cleanup crews then captured frac fluid to a container and flushed the affected area with fresh water. Before resuming operations, a detailed check was made that all connections were secure.

[1] The Cabot news release dated September 27 reported that the combined September 16 spills released a total of 7,980 gallons of frac fluid. This was based upon preliminary field reports and therefore varies slightly from the volume reported herein.

2.2 September 16, 2009 8:30 PM Release

A second release occurred at approximately 8:30 PM on the same day. A Baker Corp. report of the event indicates that a 12-inch diameter mechanical coupling fitting in the water transfer piping upstream of the feed tank manifold failed on the main well pad (**Figure 3**).[2]

The Baker Corp. report states that the surrounding valves were immediately closed, but the incident resulted in the release of approximately 5,880 gallons of frac fluid (fresh water and gel mixed at the prescribed 1,000:5 ratio) to the well pad surface. With the temporary containment measures in place from the earlier spill, an estimated minimum of 90 percent of the 8:30 PM release was contained and recovered.

According to the Cabot incident report, the Cabot completion foreman notified on-site personnel of the spill and called PADEP at approximately 9:00 PM. He then began oversight of the cleanup. As with the earlier spill, the contained frac fluid was pumped to a container and the affected area was flushed with fresh water. Before fracing operations resumed, several mechanical connections were replaced with fused high density polyethylene (HDPE) pipe connections. In addition, mechanical hose connections were replaced with flanged connections wherever possible and several hand-wheel valves were added to replace lever-type valves. An extra valve was also added on every line between the suction manifold and the feed tanks on the well pad to serve as an additional isolation valve.

Baker Corp.'s analysis of the failed fitting indicated that the metal Bauer ring on the male coupling was enlarged from 13.25" to 14", allowing the ring to rise up on the male ball which created a breach of the seal that eventually failed. According to Baker Corp., a pressure surge in the system is suspected as the cause of this failure.

2.3 September 22, 2009 6:30 AM Release

At about 6:30 AM on September 22, 2009, approximately 420 gallons of diluted frac fluid (fresh water and gel at less than the prescribed 1,000:5 rate) was spilled on to the well pad surface during fracing activities. The frac fluid was diluted because the frac job was being transitioned at this time from a water/gel mix to fresh water only in the water transfer system.

According to the Cabot incident report, this release was caused by two 8" Kanaflex flexible polyvinyl chloride (PVC) hoses that failed due to a pressure surge that occurred during the seventh stage of the Heitsman 4H frac (**Figure 3**). The valves (which were added after the second spill event described above) on both ends of the ruptured hoses were closed, preventing a larger spill. All but approximately 10 gallons of the mixture was contained in the catchment basin at the base of the well pad. The impacted area from this release did not exceed that of the

[2] Baker Corp. is Cabot's water transfer contractor for the Heitsman 4H frac.

earlier spills due to the temporary containment measures that had already been put in place (described above).

According to the Cabot incident report, the Cabot completion foreman on site immediately called response contractors for the site cleanup and to assess the area. The Cabot foreman notified PADEP at approximately 9:00 AM. Upon review of the incident by Cabot management, the decision was made at approximately 11:00 AM to suspend the frac operation at Heitsman 4H.

3.0 Equipment and Work Practices Integrity Analysis

This section provides an analysis of the integrity and validity of the water transfer system equipment and work practices associated with Cabot's hydraulic fracturing operations at PADEP-permitted well pad sites located within the confines of Susquehanna County, PA (Attachment 4). Recommendations for corrective measures to address equipment and work practice deficiencies are presented in **Section 4.0**.

3.1 Equipment

A review was conducted of the incident reports resulting from the Heitsman 4H releases and multiple post-release inspections. Similar equipment and water transfer system designs have been used multiple times without incident at other Cabot frac locations within Susquehanna County. However, the Heitsman 4H location presents different conditions (specifically, the 240' elevation differential between tank farm and well pad) than had been encountered at previous fracing locations, indicating that a more robust system may be needed when such conditions are encountered.

The water transfer system at the Heitsman 4H location was installed with a pressure reducing valve between the tank farm and the well pad to protect the downstream piping from excessive hydrostatic pressures. The use of secondary overpressure protection controls or downstream piping components with higher pressure ratings (in conjunction with the pressure reducing valve) would have provided a higher level of protection for the water transfer system. The mechanical coupling fittings and hoses used in the water transfer system at the well pad (**Figures 1** and **2**) may not have been suited for the pressure fluctuations associated with frac operations when combined with increased hydrostatic pressures from elevation differentials.

During the Heitsman 4H frac, lever-operated valves were being used at various locations along the water/frac fluid supply line. These valves allow rapid opening and closing, which can limit the amount of discharge in a spill situation but can also contribute to pressure surges within the water transfer system. These pressure surges – also known as a "water hammer" effect – are suspected to have contributed to the September 2009 releases at the Heitsman 4H well pad.

3.2 Work Practices

This section summarizes the current sequence of work practices for frac operations at Cabot sites in Susquehanna County.

Once a drilling rig has finished drilling and casing a well and moves off site, the Cabot completion foreman is notified of a stimulation (frac) date by Cabot management. The completion engineer and foreman then coordinate with vendors for the completion process, including contractors for pumping service, water supply, water transfer, well-head equipment, etc. During frac operations, each contractor directs the work of its employees to provide the required flows of water, frac gel, and sand to execute Cabot's frac procedure.

With respect to the water transfer system, Cabot selects a water transfer contractor (for the Heitsman 4H frac, this was Baker Corp.) to set up the water transfer and manifold system. The design of this system, which is prepared by the contractor, is site specific depending on frac design, location, and topography. When the water transfer contractor arrives on-site they meet with the Cabot completion foreman to discuss the layout of the water transfer system and then set it up based upon the contractor's design. Once the water transfer system is constructed, the contractor performs a hydrostatic integrity test.

While the water transfer system is being installed, the frac contractor (for the Heitsman 4H frac, this was Halliburton) sets up their frac equipment, integrating into the water transfer and manifold system. An additional five to eight water tanks, called 'feed' tanks, are placed on the well pad to provide a continuous water supply during the frac process. The frac fluid mixing equipment is then installed. If space is available on the well pad, this mixing location is placed on-site. If there is insufficient space, this operation is moved to a nearby site along the water supply line from the tank farm to the well pad.

The Cabot completion foreman is on site during fracing operations to monitor job progress, interpret data from ongoing activities, consult with the contractor's supervisors and Cabot's engineers, and provide general oversight of the entire frac process.

The required coordination between multiple contractors could increase spill potential. Cabot will employ corrective measures detailed below that focus on both administrative and engineering solutions to help assure that off-normal operations in one contractor's system do not result in a spill event.

4.0 Corrective Measures

This section sets forth the corrective measures that Cabot has identified will employ to prevent releases similar to those encountered at the Heitsman site.

4.1 Administrative Corrective Measures

Cabot is undertaking the following administrative measures to mitigate the potential for future releases:

A. Update Cabot PPC and C&D plans to reflect new information since the original plans were approved. A copy of the updated PPC Plan for Susquehanna County is being forwarded to PADEP for review and approval in conjunction with this Engineering Study.
B. Require contractors to certify that they have any necessary PPC and Spill Prevention, Containment, and Countermeasures (SPCC) Plans in place before work begins.
C. Maintain an updated version of Cabot's PPC and C&D Plans at the Cabot field office. In addition, a condensed version of the PPC plan summarizing key processes and requirements will be laminated and kept on site with the Erosion & Sediment Control Plan.
D. Require water transfer contractors to visit each site in advance and account for site-specific conditions, including elevation differentials, in their proposals for the water transfer system.
E. Require water transfer and frac contractors to include in their proposal pressure recording devices and controls to document system pressures and prevent maximum operating pressures from being exceeded.

4.2 Engineering Corrective Measures

In addition to the items identified under section 4.1 above, Cabot will undertake the following design changes and engineering measures to address the root causes of the frac releases:

A. Require contractors to perform and document hydrostatic integrity testing of all water transfer facility piping. Hydrostatic testing must be done before any materials other than water are introduced into the piping.
B. Require contractors to move additive handling and storage activities (e.g., hydraulic fracturing gel injection) onto the well pad, where feasible. In addition, contractors will be required to provide secondary containment where additive handling and storage activities take place, excluding flow-through piping. Contractors will also be required to provide additional secondary containment for any additive handling activity that must be done outside the well pad.
C. Require contractors to provide secondary containment for all fuel and oil drums (>55 gallon capacity) stored on site.
D. Require contractors to use only flanged or fused connections downstream of all additive injection points.

E. Require contractors to use at a minimum SDR-17 HDPE (or equivalent) pipe with flanged connections on both ends for all hard piping downstream of additive injection points on the water transfer system (see Attachment 5 for SDR-17 HDPE pressure ratings). Contractors will also ensure that all hoses employed in this service will be flanged hoses rated for a working pressure at or above the pressure rating of the manifold.

F. Require the water transfer contractor to use hand-wheel operated valves downstream of the additive injection point as a measure to avoid quick closure and minimize water hammer. The lever operated valves that are integral to the feed tanks will be used only in case of emergency shutdown and will be tagged accordingly.

G. Require contractors to incorporate into their proposal the installation of air/vacuum release valves and pressure relief valves (adjustable type) at appropriate locations to protect the water transfer system and prevent overpressure or collapse. Contractors will be required to connect all pressure relief valves to hoses going back to the tanks.

H. At locations with high elevation differentials, require contractors to incorporate into their proposal requirements the installation of a pressure-regulating valve to prevent the pressure within the system from exceeding the pressure rating of the system. The pressure-regulating valve will be equipped with pressure gauges and recorders on the inlet and outlet sides.

I. Require contractors to install isolation valves on long runs (>100') of discharge piping.

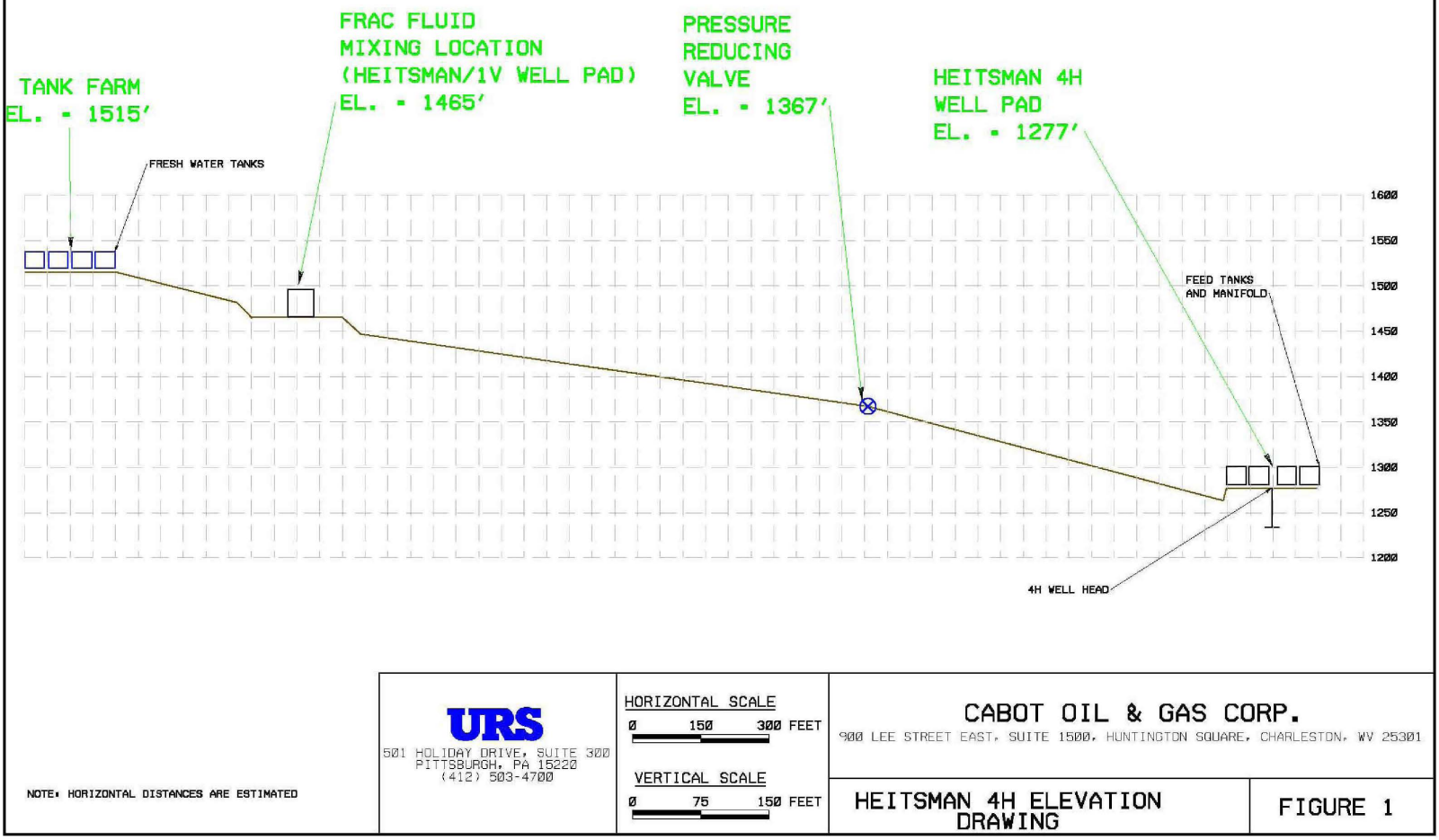
J. Revise the well pad design to provide a secondary containment berm on at least three downslope sides of the pad during frac operations (**Figure 4**).

K. Require frac contractor to install a high-pressure relief valve to work in conjunction with the existing electronic shutdown controls to protect the piping systems between the high-pressure pumps and the well head. The relief valve discharge will be piped to a tank.

L. Install a hydraulic, high-pressure shut-off valve above the two master frac valves on the wellhead.

To foster continuous improvement in the area of spill preparedness and prevention, Cabot will continue to evaluate and implement improved measures as appropriate. The evaluations will include lessons learned, processes and procedures, and new and improved technology.

FIGURES



NOTE: HORIZONTAL DISTANCES ARE ESTIMATED

URS
501 HOLIDAY DRIVE, SUITE 300
PITTSBURGH, PA 15220
(412) 503-4700

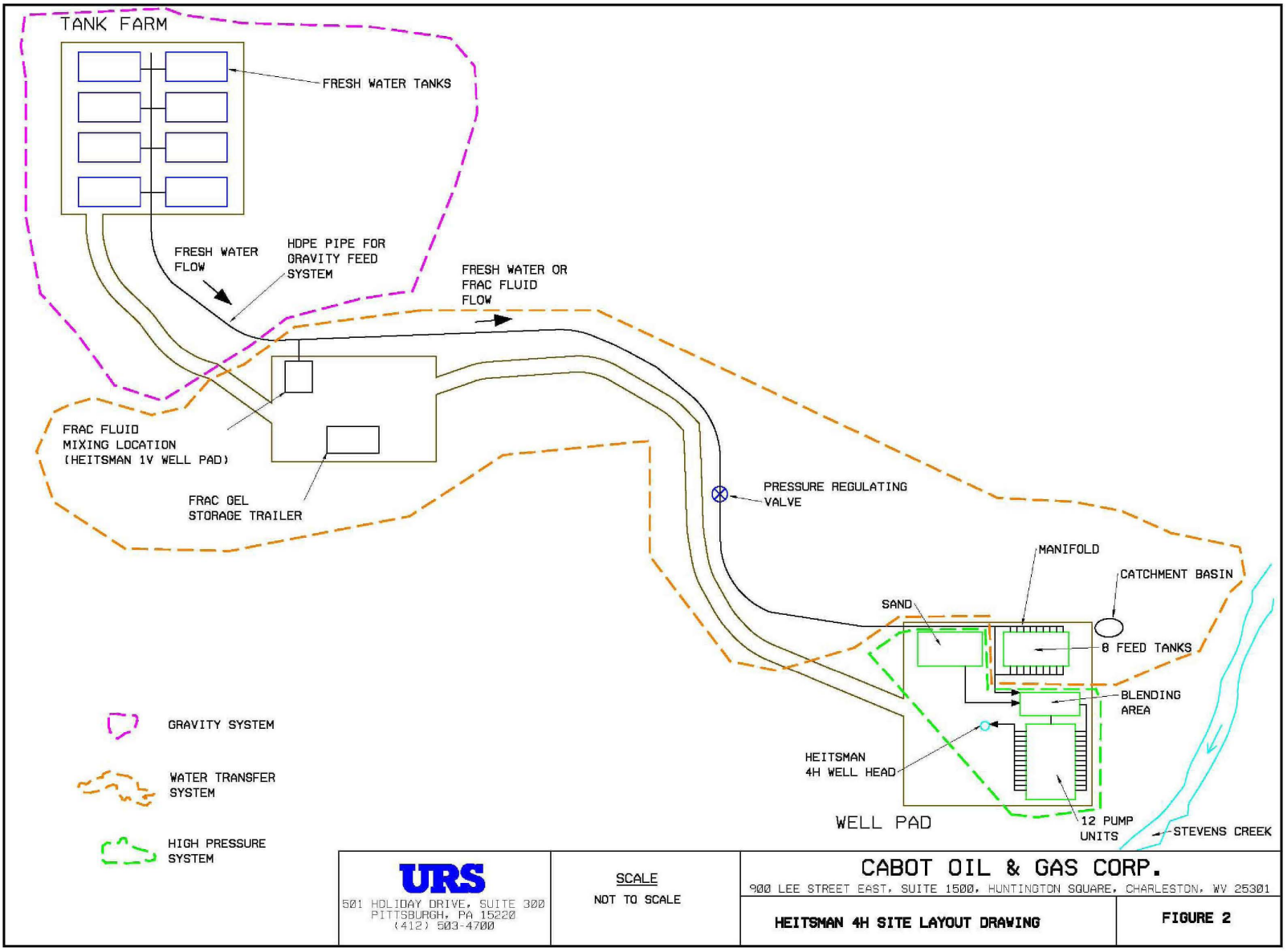
HORIZONTAL SCALE
0 150 300 FEET

VERTICAL SCALE
0 75 150 FEET

CABOT OIL & GAS CORP.
900 LEE STREET EAST, SUITE 1500, HUNTINGTON SQUARE, CHARLESTON, WV 25301

HEITSMAN 4H ELEVATION DRAWING

FIGURE 1



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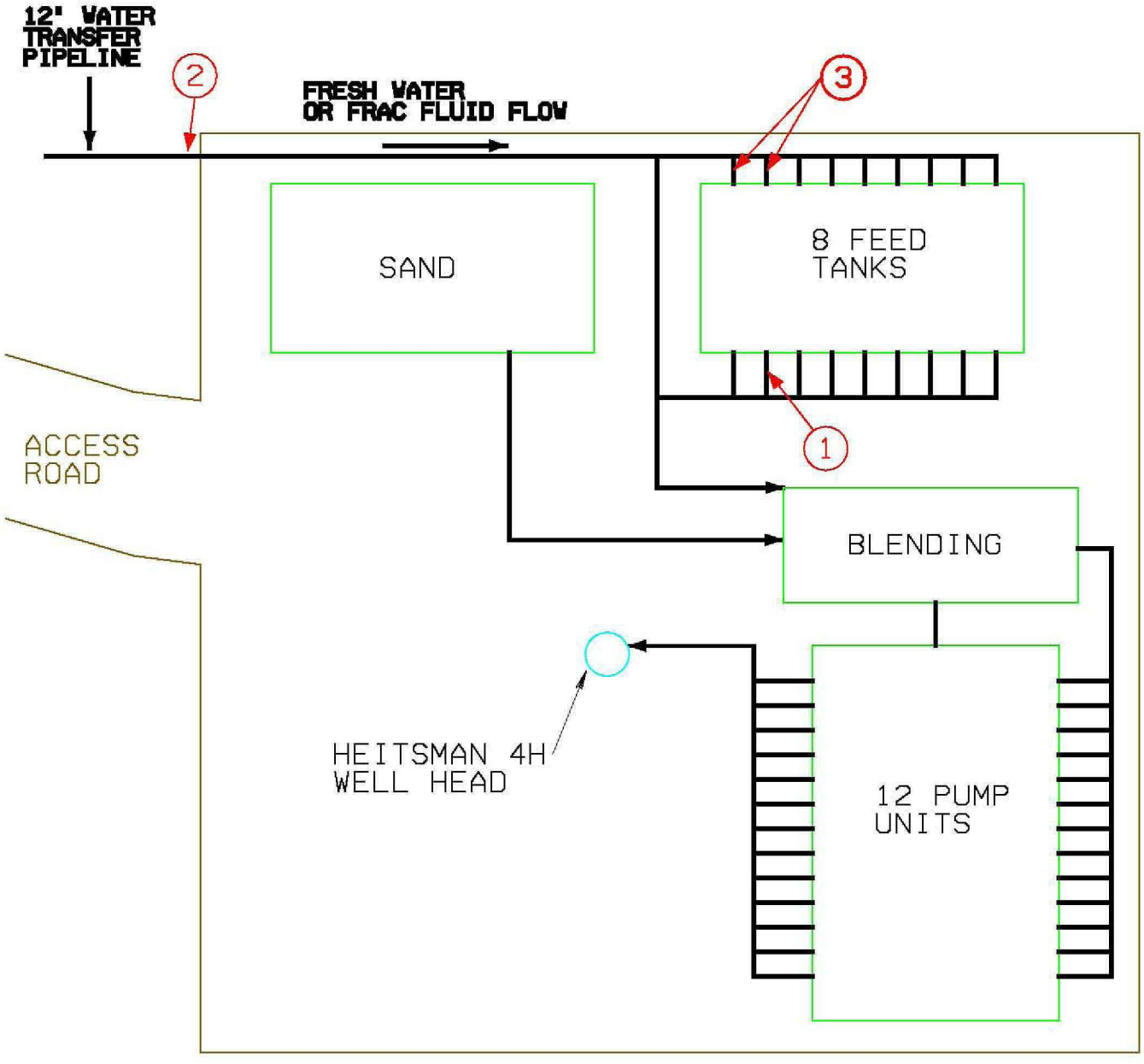
1. SEPTEMBER 16, 2009 2:00 PM RELEASE (DISCONNECTED 4" MECHANICAL COUPLING)
2. SEPTEMBER 16, 2009 8:30 PM RELEASE (FAILED 12" MECHANICAL COUPLING)
3. SEPTEMBER 22, 2009 6:30 AM RELEASE (2 RUPTURED 8" HOSES)



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(412) 503-4700

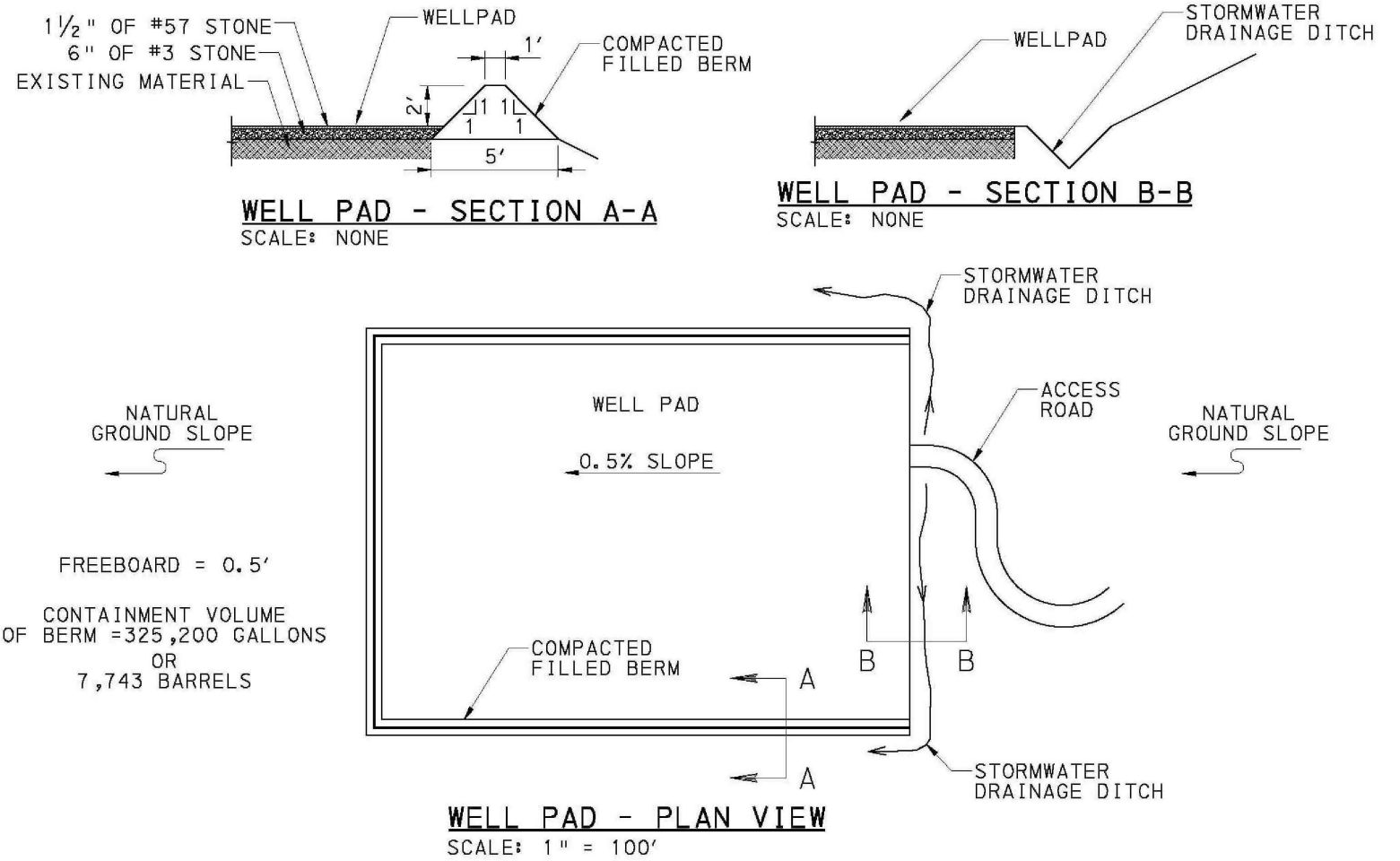
SCALE
NOT TO SCALE

CABOT OIL & GAS CORP.
900 LEE STREET EAST, SUITE 1500, HUNTINGTON SQUARE, CHARLESTON, WV 25301

HEITSMAN 4H WELL PAD SCHEMATIC

FIGURE 3

P:\1747 Projects\Cabot Oil & Gas\39939652 Cabot Well Pad E&S\Well Sites\Example for Williard\Figure 3 2D.dgn 10/6/2009



URS 501 HOLIDAY DRIVE, SUITE 300 PITTSBURGH, PA 15220 (412) 503-4700	CABOT OIL & GAS CORP. 900 LEE STREET EAST, SUITE 1500, HUNTINGTON SQ., CHARLESTON, WV 25301	
	TYPICAL WELL PAD BERM LAYOUT	FIGURE 4

DIM0198291

DIM0198304

ATTACHMENT 1
Site Photographs

PHOTOGRAPH 1: Overview of the Heitsman 4H Well Pad. (Photograph taken on September 26, 2009 after releases.)

PHOTOGRAPH 2: View of wellheads at the Heitsman site. (Photograph taken on September 26, 2009 after releases.)

PHOTOGRAPH 3: View of tank farm at the Heitsman site. (Photograph taken on September 26, 2009 after releases.)

PHOTOGRAPH 4: View of manifold on Heitsman well pad. (Photograph on September 26, 2009 taken after releases.)

PHOTOGRAPH 5: View of broken 8 inch Kanaflex flexible PVC hose from September 22, 2009, 6:30 AM release.

PHOTOGRAPH 6: View of Stevens Creek. (Photograph taken on September 21, 2009, after September 16, 2009 releases.)

PHOTOGRAPH 7: View of representative impacts to forested wetland near the Heitsman well pad. (Photograph taken on September 26, 2009 after releases.)

PHOTOGRAPH 8: View of catchment basin and hay bale and earthen dam. (Photograph taken on September 21, 2009 after September 16, 2009 releases.)

PHOTOGRAPH 9: View of a lever operated valve. (Photograph taken on September 27, 2009 after releases.)

PHOTOGRAPH 10: View of the pressure reducing valve. (Photograph taken on September 27, 2009 after releases.)

PHOTOGRAPH 11: View of the failed 12" diameter mechanical joint coupling from September 16, 2009 release. (Photograph taken September 17, 2009.)

ATTACHMENT 2
URS Personnel Background

John J. Smelko – Project Manager

Mr. Smelko is Vice President and Branch Manager of the Charleston, WV office and also Project Manager and Environmental Staff Scientist specializing in environmental remediation, decontamination and demolition projects, and environmental work. He has a very strong background in Construction Quality Assurance (CQA) work and associated Site Management, Environmental Field Sampling/Chemistry Work, Environmental Health and Safety, Technical Writing, and Organic/Inorganic Data Validation. He has been in the environmental field for over 20 years.

Robert T. Hilliard – Lead Preparer

Mr. Hilliard's technical expertise is in NEPA documentation and Environmental Impact Statement (EIS) preparation; expert testimony; transportation planning; wetland delineation, mitigation, and permitting; river and watershed conservation planning; resource conservation planning; freshwater and coastal wetland ecology; threatened and endangered species studies; terrestrial, aquatic, and marine ecological assessment; recreational trail development; and heritage area planning.

Dennis A. Guthrie, P.E.

Mr. Guthrie has supervised all aspects of site investigations and feasibility studies at numerous private and government facilities with budgets ranging from $5,000 to $9.2 million over a 25-year period. His responsibilities have included formulation and technical review of deliverable documents; procurement of subcontractors; project staffing; and the purchase of materials and equipment for environmental investigations, Act 2 closures, Brownfields redevelopment, environmental permitting, environmental resource clearances, and major construction projects. His project responsibilities have covered the entire range of project activities including design of municipal water supply piping, design of piping systems for impacted groundwater and vapor recovery systems, hydrologic analysis, water supply investigations, SPCC Plan preparation, groundwater modeling, runoff and erosion modeling, field investigations, completion of RI/FS reports, permit applications, decision documents, and RCRA and CERCLA site closures.

Joel A. Shodi, P.E.

Mr. Shodi has over 13 years of experience providing civil and environmental engineering services for a wide variety of projects funding both publicly and privately. Mr. Shodi has worked with public agencies such as the Pennsylvania Department of Transportation, the Pennsylvania Department of Environmental Protection, and the Pennsylvania Department of

Conservation and Natural Resources on various transportation related projects and understands the process involved. Mr. Shodi has a reputation of being able to complete projects for various clients on time and within schedule.

Robert Oates, E.I.T.

Mr. Oates is a project engineer with more than nine years of environmental experience. His expertise includes: permitting; reporting; water and wastewater treatment, spill prevention, control, and countermeasure (SPCC) plans and secondary containment designs; preparedness, prevention, and contingency (PPC) plans; storm water pollution prevention plans (SW3P), work plan and final report preparation; Phase I, II, and III environmental site assessments (ESAs); site characterization and delineation; subsurface investigation and analysis; remediation activities; tasks related to closure sites; Pennsylvania Land Recycling and Remediation Standards Act (Act 2) submittals for background standards and Statewide health standards; surface/ground water and soil sampling; industrial hygiene monitoring; and computer database management.

James Pinta, Jr., PhD., P.G.

Dr. Pinta has over 30 years of experience in successfully applying his technical expertise in geology, geochemistry, contaminant identification, contaminant fate and transport modeling, hydrogeology and environmental sampling, analysis and remediation to environmental projects and programs. Dr. Pinta has provided consulting and remediation services to private (industrial and commercial) and public sector clients. He has been responsible for planning and negotiating environmental study and design projects involving regulatory compliance, site characterization, risk assessment, property liability evaluations for companies that are acquiring and/or divesting sites, site remediation, and Brownfields Redevelopment.

ATTACHMENT 3
LGC-35 CBM Material Safety Data Sheet

October 9, 2009

HALLIBURTON

MATERIAL SAFETY DATA SHEET

Product Trade Name: **LGC-35 CBM**

Revision Date: 03-Jan-2008

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Trade Name: LGC-35 CBM
Synonyms: None
Chemical Family: Blend
Application: Liquid Gel Concentrate

Manufacturer/Supplier
Halliburton Energy Services
P.O. Box 1431
Duncan, Oklahoma 73536-0431
Emergency Telephone: (281) 575-5000

Prepared By
Chemical Compliance
Telephone: 1-580-251-4335
e-mail: fdunexchem@halliburton.com

2. COMPOSITION/INFORMATION ON INGREDIENTS

SUBSTANCE	CAS Number	PERCENT	ACGIH TLV-TWA	OSHA PEL-TWA
Paraffinic solvent		30 - 60%	Not applicable	Not applicable
Polysaccharide		30 - 60%	Not applicable	Not applicable

3. HAZARDS IDENTIFICATION

Hazard Overview
May cause eye, skin, and respiratory irritation. May cause headache, dizziness, and other central nervous system effects. May cause allergic respiratory reaction. May be harmful if swallowed. Potential carcinogen. Combustible.

4. FIRST AID MEASURES

Inhalation
If inhaled, remove to fresh air. If not breathing give artificial respiration, preferably mouth-to-mouth. If breathing is difficult give oxygen. Get medical attention.

Skin
In case of contact, immediately flush skin with plenty of soap and water for at least 15 minutes. Get medical attention. Remove contaminated clothing and launder before reuse.

Eyes
In case of contact, immediately flush eyes with plenty of water for at least 15 minutes and get medical attention if irritation persists.

Ingestion
Do not induce vomiting. Slowly dilute with 1-2 glasses of water or milk and seek medical attention. Never give anything by mouth to an unconscious person.

Notes to Physician
Not Applicable

5. FIRE FIGHTING MEASURES

Flash Point/Range (F):	176
Flash Point/Range (C):	80
Flash Point Method:	PMCC
Autoignition Temperature (F):	Not Determined
Autoignition Temperature (C):	Not Determined
Flammability Limits in Air - Lower (%):	0.5
Flammability Limits in Air - Upper (%):	4.9

Fire Extinguishing Media Carbon Dioxide, Dry Chemicals, Foam.

Special Exposure Hazards Use water spray to cool fire exposed surfaces. Closed containers may explode in fire. Decomposition in fire may produce toxic gases.

Special Protective Equipment for Fire-Fighters Full protective clothing and approved self-contained breathing apparatus required for fire fighting personnel.

NFPA Ratings: Health 1, Flammability 1, Reactivity 0
HMIS Ratings: Flammability 1, Reactivity 0, Health 1

6. ACCIDENTAL RELEASE MEASURES

Personal Precautionary Measures Use appropriate protective equipment.

Environmental Precautionary Measures Prevent from entering sewers, waterways, or low areas.

Procedure for Cleaning / Absorption Isolate spill and stop leak where safe. Contain spill with sand or other inert materials. Scoop up and remove.

7. HANDLING AND STORAGE

Handling Precautions Avoid contact with eyes, skin, or clothing. Avoid breathing vapors. Wash hands after use. Launder contaminated clothing before reuse.

Storage Information Store away from oxidizers. Store in a cool well ventilated area. Keep from heat, sparks, and open flames. Keep container closed when not in use. Product has a shelf life of 24 months.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls Use in a well ventilated area. Local exhaust ventilation should be used in areas without good cross ventilation.

Respiratory Protection Not normally needed. But if significant exposures are possible then the following respirator is recommended:
Organic vapor respirator with a dust/mist filter.

Hand Protection Impervious rubber gloves.

Skin Protection Normal work coveralls.

Eye Protection Chemical goggles; also wear a face shield if splashing hazard exists.

Other Precautions Eyewash fountains and safety showers must be easily accessible.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Liquid
Color:	Off white
Odor:	Odorless
pH:	6.5 - 7.5
Specific Gravity @ 20 C (Water=1):	1.034
Density @ 20 C (lbs./gallon):	8.61
Bulk Density @ 20 C (lbs/ft3):	Not Determined
Boiling Point/Range (F):	392
Boiling Point/Range (C):	200
Freezing Point/Range (F):	Not Determined
Freezing Point/Range (C):	Not Determined
Vapor Pressure @ 20 C (mmHg):	Not Determined
Vapor Density (Air=1):	Not Determined
Percent Volatiles:	Not Determined
Evaporation Rate (Butyl Acetate=1):	Not Determined
Solubility in Water (g/100ml):	Soluble
Solubility in Solvents (g/100ml):	Not Determined
VOCs (lbs./gallon):	Not Determined
Viscosity, Dynamic @ 20 C (centipoise):	Not Determined
Viscosity, Kinematic @ 20 C (centistrokes):	Not Determined
Partition Coefficient/n-Octanol/Water:	Not Determined
Molecular Weight (g/mole):	Not Determined

10. STABILITY AND REACTIVITY

Stability Data:	Stable
Hazardous Polymerization:	Will Not Occur
Conditions to Avoid	Keep away from heat, sparks and flame.
Incompatibility (Materials to Avoid)	Strong oxidizers.
Hazardous Decomposition Products	Carbon monoxide and carbon dioxide.
Additional Guidelines	Not Applicable

11. TOXICOLOGICAL INFORMATION

Principle Route of Exposure	Eye or skin contact, inhalation.
Inhalation	May cause respiratory irritation. May cause allergic respiratory reaction. May cause chemical pneumonia. May cause central nervous system depression including headache, dizziness, drowsiness, incoordination, slowed reaction time, slurred speech, giddiness and unconsciousness.
Skin Contact	Causes drying of the skin. May cause skin irritation.
Eye Contact	May cause eye irritation.
Ingestion	Irritation of the mouth, throat, and stomach. Aspiration into the lungs may cause chemical pneumonitis including coughing, difficulty breathing, wheezing, coughing up blood and pneumonia, which can be fatal. May cause central nervous system depression including headache, dizziness, drowsiness, muscular weakness, incoordination, slowed reaction time, fatigue blurred vision, slurred speech, giddiness, tremors and convulsions.

Aggravated Medical Conditions	Skin disorders.
Chronic Effects/Carcinogenicity	Contains petroleum distillates which have been shown to cause skin cancer in laboratory animals.
Other Information	None known.

Toxicity Tests

Oral Toxicity:	Not determined
Dermal Toxicity:	Not determined
Inhalation Toxicity:	Not determined
Primary Irritation Effect:	Not determined
Carcinogenicity	Not determined
Genotoxicity:	Not determined
Reproductive / Developmental Toxicity:	Not determined

12. ECOLOGICAL INFORMATION

Mobility (Water/Soil/Air)	Not determined
Persistence/Degradability	Not determined
Bio-accumulation	Not Determined

Ecotoxicological Information

Acute Fish Toxicity:	Not determined
Acute Crustaceans Toxicity:	Not determined
Acute Algae Toxicity:	Not determined
Chemical Fate Information	Not determined
Other Information	Not applicable

13. DISPOSAL CONSIDERATIONS

Disposal Method	Disposal should be made in accordance with federal, state, and local regulations.
Contaminated Packaging	Follow all applicable national or local regulations.

14. TRANSPORT INFORMATION

Land Transportation

DOT
Not restricted

DOT (Bulk)
Petroleum Distillates, N.O.S., Combustible Liquid, UN1268, III
Classified in accordance with 49 CFR 172.101(d)(4)

Canadian TDG
Not restricted

ADR Not restricted

Air Transportation

ICAO/IATA Not restricted

Sea Transportation

IMDG Not restricted

Other Shipping Information

Labels: None

15. REGULATORY INFORMATION

US Regulations

US TSCA Inventory	All components listed on inventory.
EPA SARA Title III Extremely Hazardous Substances	Not applicable
EPA SARA (311,312) Hazard Class	Acute Health Hazard Fire Hazard
EPA SARA (313) Chemicals	This product does not contain a toxic chemical for routine annual "Toxic Chemical Release Reporting" under Section 313 (40 CFR 372).
EPA CERCLA/Superfund Reportable Spill Quantity	Not applicable.
EPA RCRA Hazardous Waste Classification	If product becomes a waste, it does NOT meet the criteria of a hazardous waste as defined by the US EPA.
California Proposition 65	All components listed do not apply to the California Proposition 65 Regulation.
MA Right-to-Know Law	One or more components listed.
NJ Right-to-Know Law	Does not apply.
PA Right-to-Know Law	Does not apply.

Canadian Regulations

Canadian DSL Inventory	Product contains one or more components not listed on inventory.
WHMIS Hazard Class	B3 Combustible Liquids

16. OTHER INFORMATION

The following sections have been revised since the last issue of this MSDS
Not applicable

Additional Information

For additional information on the use of this product, contact your local Halliburton representative.

For questions about the Material Safety Data Sheet for this or other Halliburton products, contact Chemical Compliance at 1-580-251-4335.

Disclaimer Statement

This information is furnished without warranty, expressed or implied, as to accuracy or completeness. The information is obtained from various sources including the manufacturer and other third party sources. The information may not be valid under all conditions nor if this material is used in combination with other materials or in any process. Final determination of suitability of any material is the sole responsibility of the user.

*****END OF MSDS*****

ATTACHMENT 4
List of PADEP Permitted Well Sites in Susquehanna County

October 9, 2009

Report Parameters-

PF Type-	All
ICS Organization-	All
County-	58
Client AKA-	OGO-10897
Prog Alternate Id-	All

Ics Organization: 4400 EP Nc Rgnl Off Wiliamspt County: 58 Susquehanna

Drill Comm Date: 09/27/2006 PF Other Id: 115-20007 PF Name: TEEL 1
Municipality: Springville Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: 09/28/2007 PF Other Id: 115-20008 PF Name: GREENWOOD 1
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: 02/25/2008 PF Other Id: 115-20010 PF Name: TEEL 2
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: 12/02/2008 PF Other Id: 115-20011 PF Name: TEEL 6
Municipality: Springville Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20012 PF Name: TEEL 8
Municipality: Springville Township Prog Alt Id: Permit Status: CANCL
PF Status: PBNM Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20013 PF Name: TEEL 9
Municipality: Springville Township Prog Alt Id: Permit Status: CANCL
PF Status: PBNM Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20014 PF Name: BROOKS 1
Municipality: Springville Township Prog Alt Id: Permit Status: CANCL
PF Status: PBNM Plug Cert Date: Well Record Date: Well Type: GS

Ics Organization: 4400 EP Nc Rgnl Off Wiliamspt County: 58 Susquehanna

Drill Comm Date: 07/24/2008 PF Other Id: 115-20015 PF Name: ELY 2
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20016 PF Name: ELY 4
Municipality: Dimock Township Prog Alt Id: Permit Status: EXP
PF Status: PBNM Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20017 PF Name: HUBBARD 2
Municipality: Dimock Township Prog Alt Id: Permit Status: EXP
PF Status: PBNM Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20018 PF Name: KAHLE 1
Municipality: Dimock Township Prog Alt Id: Permit Status: EXP
PF Status: PBNM Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: 09/25/2008 PF Other Id: 115-20019 PF Name: GESFORD 3
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: 05/28/2009 Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20020 PF Name: HEITSMAN 1
Municipality: Dimock Township Prog Alt Id: Permit Status: CANCL
PF Status: PBNM Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20021 PF Name: HEITSMAN 2
Municipality: Dimock Township Prog Alt Id: Permit Status: EXP
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: 05/08/2008 PF Other Id: 115-20023 PF Name: TEEL 7
Municipality: Springville Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: 05/19/2008 PF Other Id: 115-20024 PF Name: TEEL 5
Municipality: Springville Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Ics Organization: 4400 EP Nc Rgnl Off Wiliamspt County: 58 Susquehanna

Drill Comm Date: PF Other Id: 115-20025 PF Name: RATZEL 1
Municipality: Dimock Township Prog Alt Id: Permit Status: CANCL
PF Status: PBNM Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: 08/13/2008 PF Other Id: 115-20026 PF Name: BAKER 1
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20028 PF Name: BLACK 1
Municipality: Springville Township Prog Alt Id: Permit Status: CANCL
PF Status: PBNM Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20029 PF Name: ELY 1
Municipality: Dimock Township Prog Alt Id: Permit Status: CANCL
PF Status: PBNM Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: 05/28/2008 PF Other Id: 115-20030 PF Name: LEWIS 2
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: 09/20/2008 PF Other Id: 115-20033 PF Name: GESFORD 2
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: 03/30/2008 PF Other Id: 115-20034 PF Name: ELY 4H
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: 06/16/2008 PF Other Id: 115-20035 PF Name: LEWIS 1
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: 07/26/2008 PF Other Id: 115-20036 PF Name: COSTELLO 1
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Ics Organization: 4400 EP Nc Rgnl Off Wiliamspt County: 58 Susquehanna

Drill Comm Date: 10/11/2008 PF Other Id: 115-20039 PF Name: HUBBARD 1
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: 02/27/2009 PF Other Id: 115-20040 PF Name: GESFORD 1
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: 04/17/2008 PF Other Id: 115-20041 PF Name: ELY 6H
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: 08/19/2008 PF Other Id: 115-20043 PF Name: COSTELLO 2
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: 01/01/2009 PF Other Id: 115-20045 PF Name: TEEL 8H
Municipality: Springville Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20046 PF Name: TEEL 9H
Municipality: Springville Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20047 PF Name: RATZEL 1H
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: 06/14/2008 PF Other Id: 115-20048 PF Name: BLACK 1H
Municipality: Springville Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: 10/23/2008 PF Other Id: 115-20049 PF Name: ELY 1H
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Ics Organization: 4400 EP Nc Rgnl Off Wiliamspt County: 58 Susquehanna

Drill Comm Date: 10/16/2008 PF Other Id: 115-20050 PF Name: HEITSMAN 1H
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: 10/06/2008 PF Other Id: 115-20051 PF Name: BROOKS 1H
Municipality: Springville Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: 12/07/2008 PF Other Id: 115-20054 PF Name: ELY 5H
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: 05/26/2009 PF Other Id: 115-20055 PF Name: TEEL 10H
Municipality: Springville Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: 07/11/2008 PF Other Id: 115-20056 PF Name: BLACK 2H
Municipality: Springville Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: 12/18/2008 PF Other Id: 115-20057 PF Name: ROZANSKI 1
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: 03/12/2009 PF Other Id: 115-20075 PF Name: R SMITH 4
Municipality: Springville Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20076 PF Name: R SMITH 3H
Municipality: Springville Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20077 PF Name: R SMITH 2H
Municipality: Springville Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Ics Organization: 4400 EP Nc Rgnl Off Wiliamspt County: 58 Susquehanna

Drill Comm Date: 03/11/2009 PF Other Id: 115-20078 PF Name: R SMITH 1H
Municipality: Springville Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20079 PF Name: SIPE 1
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: 02/07/2009 PF Other Id: 115-20080 PF Name: B SEVERCOOL 1
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20081 PF Name: A LATHROP 1
Municipality: Springville Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: 03/13/2009 PF Other Id: 115-20082 PF Name: C LARUE 2
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20083 PF Name: K LANDES 1
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: 05/11/2009 PF Other Id: 115-20084 PF Name: A HEITSMAN A1
Municipality: Springville Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20085 PF Name: GREENWOOD 2H
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20086 PF Name: FAIGLE K 1
Municipality: Springville Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Ics Organization: 4400 EP Nc Rgnl Off Wiliamspt County: 58 Susquehanna

Drill Comm Date: PF Other Id: 115-20087 PF Name: W CHUDLEIGH 2
Municipality: Springville Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20088 PF Name: W CHUDLEIGH 1
Municipality: Springville Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20089 PF Name: BROOKS W 2
Municipality: Springville Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20090 PF Name: BROOKS W 1
Municipality: Springville Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: 04/25/2009 PF Other Id: 115-20091 PF Name: GESFORD 4R
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20092 PF Name: G SHIELDS 1
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20094 PF Name: H HENGLE 1H
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20095 PF Name: J GRIMSLEY 1
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20096 PF Name: ELY 7V
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Ics Organization: 4400 EP Nc Rgnl Off Wiliamspt County: 58 Susquehanna

Drill Comm Date: PF Other Id: 115-20097 PF Name: ELK LAKE SCHOOL DISTRICT 1H
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: 04/16/2009 PF Other Id: 115-20116 PF Name: TEEL 13V
Municipality: Springville Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: 11/03/2008 PF Other Id: 115-20117 PF Name: RATZEL 3V
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20118 PF Name: G SHIELDS 2H
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20119 PF Name: A HUNSINGER 2H
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20120 PF Name: A HUNSINGER 1H
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20121 PF Name: R HULL 2H
Municipality: Springville Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20122 PF Name: R HULL 1H
Municipality: Springville Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20123 PF Name: HEITSMAN 3V
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Ics Organization: 4400 EP Nc Rgnl Off Wiliamspt County: 58 Susquehanna

Drill Comm Date: PF Other Id: 115-20130 PF Name: HUBBARD 4
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20131 PF Name: HUBBARD 3
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20132 PF Name: DEPAOLA 1
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20133 PF Name: BLACK 3V
Municipality: Springville Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20134 PF Name: D BERRY 1
Municipality: Dimock Township Prog Alt Id: Permit Status: VOID
PF Status: PBNM Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20135 PF Name: W AILEO 1
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20139 PF Name: C LARUE 1
Municipality: Dimock Township Prog Alt Id: Permit Status: CANCL
PF Status: PBNM Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: 04/15/2009 PF Other Id: 115-20140 PF Name: HEITSMAN 2
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20142 PF Name: GREENWOOD 3V
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Ics Organization: 4400 EP Nc Rgnl Off Wiliamspt County: 58 Susquehanna

Drill Comm Date: PF Other Id: 115-20147 PF Name: HUBBARD 6H
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20148 PF Name: HUBBARD 5H
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20149 PF Name: A & M HIBBARD 2H
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20150 PF Name: A & M HIBBARD 1H
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20152 PF Name: RATZEL 2H
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20158 PF Name: R SMITH 5V
Municipality: Springville Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20159 PF Name: ELK LAKE SCHOOL DIST 2V
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20160 PF Name: ELY 7H SE
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20161 PF Name: BROOKS 3V
Municipality: Springville Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Ics Organization: 4400 EP Nc Rgnl Off Wiliamspt County: 58 Susquehanna

Drill Comm Date: PF Other Id: 115-20162 PF Name: HEITSMAN 4H NW
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20163 PF Name: GESFORD 7H NW
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20164 PF Name: B SEVERCOOL 2H NW
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20165 PF Name: H HENGEL 3V
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20166 PF Name: H HENGEL 2H SE
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20167 PF Name: TEEL 12H NW
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20168 PF Name: A LATHROP 2H NW
Municipality: Springville Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20170 PF Name: G SHIELDS 5H NW
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20171 PF Name: J GRIMSLEY 2H SE
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Ics Organization: 4400 EP Nc Rgnl Off Wiliamspt **County:** 58 Susquehanna

Drill Comm Date: **PF Other Id:** 115-20172 **PF Name:** C LARUE 3H SE
Municipality: Dimock Township **Prog Alt Id:** **Permit Status:** ACT
PF Status: ACTIV **Plug Cert Date:** **Well Record Date:** **Well Type:** GS

Drill Comm Date: **PF Other Id:** 115-20173 **PF Name:** R HULL 3V
Municipality: Springville Township **Prog Alt Id:** **Permit Status:** ACT
PF Status: ACTIV **Plug Cert Date:** **Well Record Date:** **Well Type:** GS

Drill Comm Date: **PF Other Id:** 115-20176 **PF Name:** W BROOKS 4H SE
Municipality: Springville Township **Prog Alt Id:** **Permit Status:** ACT
PF Status: ACTIV **Plug Cert Date:** **Well Record Date:** **Well Type:** GS

Drill Comm Date: **PF Other Id:** 115-20177 **PF Name:** HOOVER 2H SE
Municipality: Dimock Township **Prog Alt Id:** **Permit Status:** ACT
PF Status: ACTIV **Plug Cert Date:** **Well Record Date:** **Well Type:** GS

Drill Comm Date: **PF Other Id:** 115-20178 **PF Name:** A HUNSINGER 3H NW
Municipality: Dimock Township **Prog Alt Id:** **Permit Status:** ACT
PF Status: ACTIV **Plug Cert Date:** **Well Record Date:** **Well Type:** GS

Drill Comm Date: **PF Other Id:** 115-20179 **PF Name:** A HUNSINGER 4H NW
Municipality: Dimock Township **Prog Alt Id:** **Permit Status:** ACT
PF Status: ACTIV **Plug Cert Date:** **Well Record Date:** **Well Type:** GS

Drill Comm Date: **PF Other Id:** 115-20181 **PF Name:** G SHIELDS 4H SE
Municipality: Dimock Township **Prog Alt Id:** **Permit Status:** ACT
PF Status: ACTIV **Plug Cert Date:** **Well Record Date:** **Well Type:** GS

Drill Comm Date: **PF Other Id:** 115-20183 **PF Name:** GESFORD 8H NW
Municipality: Dimock Township **Prog Alt Id:** **Permit Status:** ACT
PF Status: ACTIV **Plug Cert Date:** **Well Record Date:** **Well Type:** GS

Drill Comm Date: **PF Other Id:** 115-20187 **PF Name:** GESFORD 9
Municipality: Dimock Township **Prog Alt Id:** **Permit Status:** ACT
PF Status: ACTIV **Plug Cert Date:** **Well Record Date:** **Well Type:** GS

Ics Organization: 4400 EP Nc Rgnl Off Wiliamspt County: 58 Susquehanna

Drill Comm Date: PF Other Id: 115-20189 PF Name: W CHUDLEIGH 3H NW
Municipality: Springville Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20194 PF Name: L ROBINSON 1
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20195 PF Name: L ROBINSON 2
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20196 PF Name: P KELLEY 1
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20197 PF Name: B RUSSO 4
Municipality: Springville Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20198 PF Name: B RUSSO 5
Municipality: Springville Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20199 PF Name: W CARLSON 2
Municipality: Springville Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20200 PF Name: W CARLSON 3
Municipality: Springville Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20201 PF Name: GESFORD 5H NW
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Ics Organization: 4400 EP Nc Rgnl Off Wiliamspt County: 58 Susquehanna

Drill Comm Date: PF Other Id: 115-20203 PF Name: B RUSSO 2
Municipality: Springville Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20204 PF Name: B RUSSO 3
Municipality: Springville Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20207 PF Name: HOOVER 1V
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20217 PF Name: C LARUE 1
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20219 PF Name: C LARUE 4
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20220 PF Name: C LARUE 6
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20221 PF Name: A & M HIBBARD 3
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20222 PF Name: A & M HIBBARD 4
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20223 PF Name: GREENWOOD 6
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Ics Organization: 4400 EP Nc Rgnl Off Wiliamspt County: 58 Susquehanna

Drill Comm Date: PF Other Id: 115-20224 PF Name: GREENWOOD 7
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20225 PF Name: W BROOKS 5
Municipality: Springville Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 115-20226 PF Name: BAKER 3
Municipality: Dimock Township Prog Alt Id: Permit Status: ACT
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Drill Comm Date: PF Other Id: 720300 PF Name: ELY 1
Municipality: Dimock Township Prog Alt Id: Permit Status:
PF Status: ACTIV Plug Cert Date: Well Record Date: Well Type: GS

Total PFs for County: 128

Total PFs for ICS Org: 128

ATTACHMENT 5
Contractor Recommendations

October 9, 2009

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September 25, 2009

Cabot Oil & Gas Corporation
900 Lee Street East, Suite 1500
Charlestown, WV 25301

Attention: Gary Hlavinka

RE: Recommendations for Transferring Water on Well Site at All Future Sites

Dear Mr. Hlavinka:

I want to thank you, Phill Hill, Steve Barrett, and Larry Fulmer for taking the time yesterday to review the sites and discuss the present issues. I am going to make recommendations moving forward for the handling of the transfer of feeder water for future sites and Severcool.

My following recommendations are the use of the 12" quick disconnect manifold assemblies that are presently being used at the tank farms and feed the pumps, stay as they are now. These systems are proven to be successful and flexible and do not warrant any change. From the pumps forward on the discharge side of the system will need to have some changes from this point forward:

1. All systems will be reviewed prior to installation by a second party at BakerCorp. This will include either the Engineering Department or me.
2. Any changes in field applications that happen after review will be submitted for a second review.
3. All elevations will be determined by GPS and recorded.
4. All manifolds used on the discharge of the system will be SDR-17 and flanged on the ends.
5. All pipe and fittings will be fused together or flanged onsite for a 100% restrained discharge system. This will also allow for a custom fit for varying layouts. All 12" HDPE tees and fittings will be SDR-17 or greater.
6. The 12" valves on the discharge will be hand wheel style and not lever style to avoid quick closure and avoid water hammer.
7. A 2" air/vacuum release valve will be installed at the beginning of the system near the pumps at any high points in the system and at the end of the system to assure that the piping either has enough air or to release any trapped air from the system.
8. A minimum of two 2" pressure relief valves (adjustable type), depending on system pressure, will be installed at the beginning of the line near the pumps and at the end of the line. All pressure relief valves will be connected to hoses going back to the tanks. These valves will help remove any pressure spikes that may occur.
9. All the 8" Kanaflex SR hoses rated for 70 psi (working pressure) will be replaced with 8" x 20' heavy duty black water suction hoses with crimped Bauer fittings, which is rated for 150 psi (working pressure) and factory tested to 225 psi.

10. The 8" rear feeder valves will be replaced with 8" hand wheeled valves on the manifold, to reduce the chance of quick shut down and water hammer. The 8" Bauer locking handle will be secured with heavy duty tie wraps on both ends.
11. All tees and control valves will have isolation valves, with a minimum of at least two.
12. Isolation valves will be installed on long runs of discharge piping.
13. On systems designed for pressures not exceeding 60 psi, SDR-26 pipe will be acceptable. For any system with pressures above 60 psi, SDR-17 pipe will be used.
14. The pressure reducing valve will be outfitted with pressure gauges on the inlet and outlet sides. This valve will be used to reduce line pressure in the discharge line when elevation changes require it. A 12" bypass line will be installed around the valve as well. The psi differentials will be logged.
15. The blender trucks will be fed off the working tanks instead of the manifold system in front to avoid pressure shock should a pump shut down.
16. The working tank manifold used will have 4" valves installed for isolation, used on site.
17. All 4" hoses will be check again at the tank connection and at the manifold connection assure lever locking position.
18. Pressure gauges will be installed at the discharge of the pumps and at the end of the system to monitor system pressure and logged pressures of the system during fracs.
19. The system will be hydrostatically tested to 1 ½ times system pressure requirements and held for two hours.
20. All 12" discharge lines will be drained of water should the frac be delayed for more than one day and loaded once the frac is confirmed to happen.
21. No system will be dismantled until approval from a Cabot representative.
22. For installation of 8" x 20' heavy duty black water suction hoses for rear feed system, the working tanks will need to be placed in a straight line, 9 feet on center, with a minimum of 20 feet of access at the rear of the tanks.
23. All o-rings will be inspected prior to installation.

Best regards,

Carroll Hunnewell
Regional Pump Manager

CC: Jon Heslin
Tom Bullis
Ron Hudash
Kevin Kerezsi

PERFORMANCE PIPE
A Division of Chevron Phillips Chemical Company LP

PerformancePipe.com

Pressure Ratings

Driscoplex® PE 3608[1] Municipal Pipe Pressure Ratings At 80°F

Pipe DR	Working Pressure Rating[2] (psi)	Allowable Total Pressure[3] During Recurring Surge (psi)	Allowable Total Pressure During Occasional Surge (psi)
9	200	300	400
11	160	240	320
13.5	125	185	250
17	100	150	200
21	80	120	160
26	65	100	130

1 Previously described as PE3408 in older standards.

2 Working Pressure Rating is the Maximum Continuous Pressure Allowed Assuming the Recurring and Occasional Surge Allowances Incorporated above are not exceeded per AWWA C906 and AWWA M55.

3 Total Pressure equals the sum of the Pumping pressure and the Repetitive Transient Surge Pressure. PE Pipes have a built-in Surge Allowance for Repetitive Transient Surge due to their excellent resistance to fatigue. See Performance Pipe Brochure PP402 for additional information on PE pipe's resistance to fatigue.

4 The maximum allowable leak test pressure is equal to the allowable total pressure during recurring surge.

When Performance Matters Rely on Performance Pipe

October 2009

Bulletin PP401-3608

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